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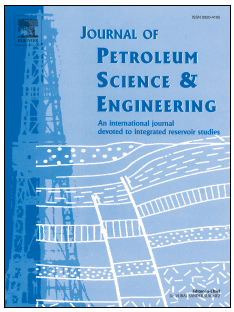

Pore characteristics of Damodar valley shale and their effect on gas storage potential

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Pore characteristics of Damodar valley shale and their effect on gas storage potential

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Highlights

- The organic and inorganic composition of shale samples were analyzed.
- Micro and mesopore characteristics of shale were discussed.
- Methane gas storage capacity in shale was explored.
- Effect of shale composition on pore structure and methane adsorption capacity was investigated.

Abstract

The current global interest in fine grained sedimentary shale rock is driven by its ability to store gas in the pore spaces in them. The current study focuses on the understanding of the gas storage capacity of less explored Damodar Valley shales of India, in light of pore characteristics of organic matter and clay minerals. In this study, four samples were collected from different parts of Damodar valley basin and their geochemical composition, pore structure and adsorption capacity were investigated by XRD studies, rock-eval analyses, low-pressure N_2-CO_2 adsorption analyses and high-pressure methane adsorption experiment. The samples were also studied to know their hydrocarbon potential. The relationship between mineralogy, organic matter, and pore-structure was analyzed and finally, their effect on methane sorption capacity was discussed. The shale samples are found to be clay rich. The average clay content of the shale samples is 50.69% and average quartz content is 31.65%. Presence of excellent TOC content (4.8% - 37.36%) with a predominance of type III organic matter and Tmax varying from 440°C - 465°C suggests a very good to excellent hydrocarbon generation potential in all the samples. The correlation between the TOC and V_L was found to be positive indicating a positive influence of organic matter on methane sorption capacity of the studied samples. However, a lack of correlation between total clay and CH_4-V_L indicates that the role of clay minerals on methane sorption behavior of these shales are inconclusive. A positive correlation between CO_2 micropore volume, CH_4-V_L and TOC suggest microporous nature of organic matter within the shale samples and their positive control on methane sorption potential. The negative correlation of clay mineral with CO_2 micropore volume suggests a lack of microporosity in the clay minerals of the collected shale samples. It was also observed that thermally mature shale samples have higher micropore volume and surface area, and are prone to higher methane sorption capacity compared to that of less mature shales.

Keywords

Organic matter; Mineralogy; Pore characteristics; Microporosity; Sorption; Shale gas reservoirs.